**Unit Plan**

**Logistics Information**:

* 1. Grade Level: 10th Grade
  2. Course Name: Biology (Regular)
  3. Instructor: Anne Boesen

**Background Information**:

Describe your classroom. What would an observer need to know about the learners in your classroom and the climate/culture of your school? Describe this course in the sequence of a student’s learning career – where does it fit?

The learners in my classroom are a mix of advanced, average and special needs students because biology is required for all students in high school. The culture and climate of the school is one where expectations are high for learning and there is a belief that everyone can learn. The culture is a suburban high school in the Des Moines area with a higher percentage of white ethnicity than other represented ethnicities however; we do have ELL students from all different backgrounds.

This course would be after the students have studied the cell and cell reproduction. After this unit we would move right into genetics.

**Unit Name: DNA and Genes Approximate Length: 10 days**

|  |  |
| --- | --- |
| **Enduring Understanding(s):** Students will understand that DNA is virtually the same for all life forms, creates proteins/enzymes critical to the functions needed for life, is the molecular basis of heredity, contains genetic code for cell to run its chemical factories and reproduce which leads to variations and similarities within and between organisms. | |
| **Essential Question(s):**  If all living things have similar DNA molecules, what might we infer from that?  Why does the structure of the DNA matter?  How did the community of science discover what we know today about DNA?  How can organisms be so different from each other if their genetic material is made of the same four nucleotides?  How does DNA end up being a protein?  How does the cell create proteins used for its own functions – which lead to gene expression?  How does the structure of DNA relate to how traits are directly passed to offspring?  How is DNA the basis of heredity and traits?  How do variations in species and populations occur? | |
| **Content- Students will know:**   1. All living cells have these similar types of complex molecules. 2. It took a community of scientist to put all the information together that we now know about DNA 3. DNA is modular – built from nucleotides – built from molecules Nucleotides are made up of :    1. Phosphate group    2. Sugar –    3. Base – A,C,G,T 4. Structure of DNA – Double Helix or ladder shape. 5. Sequence of Base Pairings 6. Multiple molecules of DNA create “genes”. 7. Replication of DNA – process by which DNA copies itself before mitosis and meiosis. Leads to exact copies by splitting two strands and adding two new strands to the two old strands. 8. DNA Contains genetic code for cell to run its chemical factories, create proteins and reproduce. 9. Compare DNA vs. RNA 10. Protein Synthesis – mRNA, tRNA Transcription/Translation, amino acids 11. Variations and similarities in organisms result from DNA combinations in genes via sexual reproduction. 12. DNA and heredity – DNA is the molecular basis of Heredity where information is passed from parent to offspring. 13. Understand the different types of mutations. 14. Mutations can occur in somatic cells but are not passed to offspring. Only mutations in gametes will be passed to offspring. 15. The importance and relevance of the Human Genome project. 16. Definitions of :     1. Deoxyribose     2. DNA     3. mutagens     4. replication     5. enzyme     6. transcription     7. translation     8. gene expression     9. condons     10. anticodon     11. intron     12. exons     13. ribose     14. DNA     15. RNA     16. Point mutation     17. Frame work mutation     18. mutagens | **Skill(s)- Students will be able to:**   1. Explain why the fact that all living cells have similar types of DNA molecules is important to understanding evolution. 2. Recognize the different scientists’ contributions to the discovery of DNA. 3. Recognize two pieces of information that enabled Watson and Crick to discover the double helix shape of DNA. 4. Describe the modular parts of nucleotides and the names of the nitrogen bases. 5. Explain the structure of DNA, the sequence of the base pairings and how the structure leads to exact copies of itself during replication. 6. Recognize that multiple nucleotides strung together create different genes that house the genetic code. 7. Analyze replication of DNA and its importance to heredity. 8. Recall that DNA contains the genetic code for cell to run its chemical factories, create proteins and reproduce. 9. Examine the process of transcription and translation in the formation of proteins 10. Differentiate DNA from RNA 11. Interpret mRNA codons, amino acids and tRNA anti-codons from original DNA gene sequences. 12. Explain how gene combinations via sexual reproduction result in variations and similarities in organisms. 13. Explain DNA’s role in Heredity. 14. Propose how Gene combinations cause variations, organisms with new capabilities or can be deleterious. 15. Discuss how only mutations in gametes can be passed to future generations and mutations in somatic cells will not. 16. Examine how the mapping genes in the human genome project could be important to genetics and disease research 17. Recognize, Match or Define the following terms: 18. Deoxyribose 19. DNA 20. mutagens 21. replication 22. enzyme 23. transcription 24. translation 25. gene expression 26. condons 27. anticodon 28. intron 29. exons 30. ribose 31. DNA 32. RNA 33. Point mutation 34. Frame work mutation 35. mutagens |
| **Assessment(s):**  Think Pair Share & Question Generating  Jigsaw, Presentation and timeline of Scientists  Quick Lab on DNA Structure from Textbook  3-2-1formative assessment on DNA, Genes, Nucleotides  Venn Diagram of DNA vs. RNA in notebooks  Muddiest Point Assessment  Quiz on DNA structure, replication, RNA  Graphic Organizer of Replication of DNA vs. Transcription  Worksheet on Mutations  Juicy Question  All Aboard for Protein Synthesis Lab  Snork Lab  Worksheet on Transcription Translation (if time permits and is needed)  Human Genome Project Webquest  Unit Test | |
| **Additional Resources**  Textbook  Computer access at computer lab on Days 9 and 10 for webquest  tour of “What is DNA?” at <http://learn.genetics.utah.edu/content/begin/tour/index.html>  Articles on Scientists  video: [DNA Transcription Translation Simulation](http://www.dnatube.com/video/3059/DNA-Transcription-and-Protein-Assembly)  <http://www.nature.ca/genome/04/0413_e.cfm#010>  [Decoding the Human Genome Project](http://questgarden.com/23/30/8/060422170530/) webquest  [**http://www.pbs.org/wgbh/aso/tryit/dna/**](http://www.pbs.org/wgbh/aso/tryit/dna/) | |

**Daily Lesson Plans**

|  |  |  |  |
| --- | --- | --- | --- |
| **Day One – Intro** | | | |
| **Phase of the Lesson –**  **Engage Explore**  **Explain Elaborate Evaluate** | **Reason/Rationale for this Activity OR Goal for this Activity** | **Description of Learning Activity (include approximate time allocation)** | **Evidence of Student Understanding** |
| Engage | Assess Prior Knowledge and make Connections to it  Promote Curiosity  Assess Misconceptions with Think-Pair –Share.  Essential Question: “If All living things have similar DNA molecules;  what might we infer from that?” | 1. Background Review of chromosome structure, mitosis and meiosis. (5 min) 2. “Four Corner” activity: Different physical attributes go to different corners of the room. (freckles, dimples, tongue roll, etc). (5 min) 3. Think Pair and Share-Essential question and discussions:    1. “Why do you look the way you do and have the physical attributes you have vs. your partner?” (15 min)    2. Question Generating: One How and a Why? (15 min) 4. Introduction to DNA using analogy of a book. (Display huge stack of books) Overview of DNA’s role in creating proteins and how proteins are critical for all living organisms’ functions. Discussion on essential question. (15 min) 5. Students fill out Unit Objective Sheet with the “I Can” statements and rate their own level of confidence on objectives. (5 min) | 1. Pair and Share results 2. Document Think-Pair-Share and One How and a Why results for reference later in the unit. 3. Walk around and view “I Can” Statements. |

|  |  |  |  |
| --- | --- | --- | --- |
| **Day Two – DNA Structure and Base Pairing Sequences** | | | |
| **Phase of the Lesson –**  **Engage Explore**  **Explain Elaborate Evaluate** | **Reason/Rationale for this Activity OR Goal for this Activity** | **Description of Learning Activity (include approximate time allocation)** | **Evidence of Student Understanding** |
| Explain/Explore | Understand the Structure of DNA is modular, complimentary and adheres to Chargaff’s Rule.  Make their own “model” of DNA  Essential question: Why does the structure of the DNA matter? | 1. Watch the tour of “What is DNA?” at <http://learn.genetics.utah.edu/content/begin/tour/index.html> (8 min) 2. Display and discover the DNA model from the classroom showing the double helix through whole class discussion. (5 min) 3. Discuss Nucleotides structure and how they build the “ladder” including bonding. (10 min) 4. Chargaff’s Rule, DNA is complementary – Examples on Board to work on with a partner (5 min) 5. Quick Lab to model their own strand of DNA in groups of 3 to 4 students. Construction paper on magnets of molecules to each team. (15 min) [*DNA pieces.doc]* Save DNA strands for later use. | 1. Quick Lab- DNA strand. Teacher check-off before they can leave. |

|  |  |  |  |
| --- | --- | --- | --- |
| **Day Three – Community of Scientists** | | | |
| **Phase of the Lesson –**  **Engage Explore**  **Explain Elaborate Evaluate** | **Reason/Rationale for this Activity OR Goal for this Activity** | **Description of Learning Activity (include approximate time allocation)** | **Evidence of Student Understanding** |
| Explore | Understand the NOS and the different scientist who contributed to our current understanding of DNA.  Essential Question: How did the community of science discover what we know today about DNA? | 1. 3-2-1 Assessment to review prior two days learning.(5) 2. In Groups, jigsaw articles on different scientists who lead to the different discoveries related to DNA. Griffith, Avery, Rosalind Franklin, Watson   and Crick and Chargaff. (20 min)   1. Groups share information found via “quick fact” posters and presentations. (20 min) 2. Student led - create timeline on board from presentations as whole class. (5 min) | 1. 3-2-1formative assessment on DNA, Genes, Nucleotides. 2. Jigsaw worksheets/ posters 3. Special Needs or ELL Differentiation would be peer tutoring: Have group members assist these students by reading to them. Or if I can find videos on-line that would have the same information, they could watch those. 4. Presentation/Discussion and timeline. 5. Timeline of major contributions in Notebooks. |

|  |  |  |  |
| --- | --- | --- | --- |
| **Day Four – Genes, DNA Replication** | | | |
| **Phase of the Lesson –**  **Engage Explore**  **Explain Elaborate Evaluate** | **Reason/Rationale for this Activity OR Goal for this Activity** | **Description of Learning Activity (include approximate time allocation)** | **Evidence of Student Understanding** |
| Explain | Understand concept of genes  Essential Questions:  “How can organisms be so different from each other if their genetic material is made of the same four nucleotides?”  Understand how a DNA strand replicates itself identically  “How does the structure of DNA relate to how traits are directly passed to offspring?” | 1. Quiz (10 min) 2. Whole Class Student Led - Activity: Make as many words as you can from four letters given to class. (5 min) 3. Review DNA Structure and discuss the order of nucleotides creates different genes. Explain how animals that are classified close to each other have similar strands of nucleotides = “genes & genetic code. (5-10 min) 4. Replication Inquiry– Get paper models from day one. Use for model of replication. Student’s split their models down the middle “being” the *DNA helicases* breaking the bonds. Then they will be the *DNA polymerases* creating complementary strands to each unzipped strand thus creating 2 new identical strands. (10 min) 5. Discussion/Lecture on the process (10 min) | 1. Quiz on DNA 2. Replication Inquiry – teacher check off. |

|  |  |  |  |
| --- | --- | --- | --- |
| **Day Five – Protein Synthesis; From DNA to Protein** | | | |
| **Phase of the Lesson –**  **Engage Explore**  **Explain Elaborate Evaluate** | **Reason/Rationale for this Activity OR Goal for this Activity** | **Description of Learning Activity (include approximate time allocation)** | **Evidence of Student Understanding** |
| Explore | Essential question answered: “How does the cell create proteins used for its own functions – which lead to gene expression?”  Venn Diagram is to separate the differences in their minds between DNA and RNA, because when two things are so similar in name, students tend to confuse them.  The muddiest point is for me to assess which points of transcription and translation the students didn’t get on the initial coverage of the topic. | 1. Quick Decoding activity to relate it to Protein Synthesis (5 min) 2. Review RNA – structure, where it can be found, types, etc... (5 min) 3. Compare RNA to DNA and note three differences.    1. Single strand    2. Ribose    3. Uracil (5 min) 4. Introduce and demonstrate transcription through demonstration and examples on board. (mRNA equates to text messaging ) (10 min) 5. Introduce and demonstration translation using book analogy. The **words** are analogous to an amino acid. When the words are put together they make a sentence. The **sentence** is analogous to a protein. (10 min) 6. Create Venn Diagrams with partner in notebook. (10 min) 7. Muddiest point in their notebooks. | 1. Venn Diagram of DNA vs. RNA in notebooks. 2. Muddiest Point Assessment– ticket out the door. |

|  |  |  |  |
| --- | --- | --- | --- |
| **Day Six – - Protein Synthesis (continued)** | | | |
| **Phase of the Lesson –**  **Engage Explore**  **Explain Elaborate Evaluate** | **Reason/Rationale for this Activity OR Goal for this Activity** | **Description of Learning Activity (include approximate time allocation)** | **Evidence of Student Understanding** |
| Explore/Elaborate | Essential Questions Answered:  How does DNA end up being a protein?  Reinforce and give feedback to students on prior day’s instruction.  Continue to expand on protein synthesis.  Differentiate between DNA replication and Transcription.  Practice reading the genetic code to decipher amino acids from mRNA codons. | 1. Watch video: [DNA Transcription Translation Simulation](http://www.dnatube.com/video/3059/DNA-Transcription-and-Protein-Assembly)  (8 min) 2. Review Prior Day’s instruction based on “Muddiest Point” feedback (5 min) 3. Graphic Organizer showing differences between DNA replication and Transcription. (5-10 min) 4. Ribosome “Protein Synthesis Train” discussion on mRNA, rRNA, and tRNA (10 min) 5. Introduce, explain and interpret “Genetic code” – whole class demonstration of amino acid “table” and how to read genetic code.(5-10 min) 6. Form teams and interpret amino acid sequences from mRNA then from DNA. (10 min) | 1. Graphic Organizer of Replication of DNA vs. Transcription   Differentiation for Special Needs or ELL would be verbal discussion of differences with me.   1. Answers to examples on the board. |

|  |  |  |  |
| --- | --- | --- | --- |
| **Day Seven- Protein synthesis Lab** | | | |
| **Phase of the Lesson –**  **Engage Explore**  **Explain Elaborate Evaluate** | **Reason/Rationale for this Activity OR Goal for this Activity** | **Description of Learning Activity (include approximate time allocation)** | **Evidence of Student Understanding** |
| Evaluate and Elaborate | Gives the students opportunities to practice with DNA codes and turning them into amino acid strands and to show gene expression.  How is DNA the basis of heredity and traits? | 1. “All Aboard for Protein Synthesis” lab – Whole Class ( 20 min) 2. SNORK Lab in groups ( 15 min) 3. Worksheet with additional DNA codes to decipher (*if needed and time allow*s; just extra practice) | 1. Lab Results and questions related to Lab 2. Snork Lab Results-   Differentiation for Special Needs or ELL would be peer tutoring and peer assistance on these labs. |

|  |  |  |  |
| --- | --- | --- | --- |
| **Day Eight – Effects of Mutations – Harmful, Helpful, neutral – Variations, etc...** | | | |
| **Phase of the Lesson –**  **Engage Explore**  **Explain Elaborate Evaluate** | **Reason/Rationale for this Activity OR Goal for this Activity** | **Description of Learning Activity (include approximate time allocation)** | **Evidence of Student Understanding** |
| Explain and Evaluate | Essential question: How does variation in species occur?  Understand how mutations lead to variation and sometimes disease or death.  Reflect on initial questions from beginning of unit.  Understand that the effect of environment on heredity is only if the gametes are affected by an environmental factor. | 1. Demonstrate Mutations : Point mutations & Framework mutations Insertions, Deletions, Additions, Inversions, Translocations (10min) 2. Whole class examples of mutations on-line at [Mighty Mutation Maker](http://www.nature.ca/genome/04/0413_e.cfm#010) (5- 10 min) 3. Pair up with partner and complete Mutation worksheet. (5 min) 4. Relate to back to Physical (Gene Expression) attributes and variations in populations and evolution. Relate effect of environment on gene expression- not to somatic cells. Discuss how mutations can be neutral, advantageous and disadvantageous. (10 min) 5. Refer back to Think –pair-share results. Whole class discussion and input. (5 -10) 6. Juicy Question – answered in notebook. ( 5 min or homework) | 1. Worksheet on Mutations 2. Correct/Update Original Think-Pair-Share from Day 1 with any new thoughts on the question and answers to their “question generating” questions. 3. Juicy Question answered in lab notebook for “Passport” out the door. “*In an experiment with rats, the treatment group receives radiation while the control group does not. Months later, the treatment group has a greater percentage of rats with cancer and newborn rats with birth defects than the control group. Explain these observations.”* |

|  |  |  |  |
| --- | --- | --- | --- |
| **Day Nine – Webquest assigned** | | | |
| **Phase of the Lesson –**  **Engage Explore**  **Explain Elaborate Evaluate** | **Reason/Rationale for this Activity OR Goal for this Activity** | **Description of Learning Activity (include approximate time allocation)** | **Evidence of Student Understanding** |
| Elaborate | Understanding the purposes of uncovering the human genetic code.  Understanding the differences and similarities in the genetic code of humans and disease research.  Connecting to the science community at large with real world issues. | [Decoding the Human Genome Project](http://questgarden.com/23/30/8/060422170530/)  Teams of 3-4 have class work-time to complete web quest in Library. | 1. Walk around checking on progress of web quest. 2. Differentiation on Web quest :   Students can:  1.Create brief power point  2. Create a poster with information  3. Oral presentation |

|  |  |  |  |
| --- | --- | --- | --- |
| **Day Ten –Webquests on Human Genome Project Due – Review for Unit Summative Assessment** | | | |
| **Phase of the Lesson –**  **Engage Explore**  **Explain Elaborate Evaluate** | **Reason/Rationale for this Activity OR Goal for this Activity** | **Description of Learning Activity (include approximate time allocation)** | **Evidence of Student Understanding** |
| Evaluate | Have students self-test so that they know where they need to study.  Review information for test. | 1. Have students evaluate their knowledge “After Instruction” with objectives on Unit handout. (5-10) 2. Work on Web Quest (25 min) 3. Review Game (Quiz Bowl or Jeopardy) (15 min) | 1. Answers on Jeopardy – If student gets answer wrong, I will ask them to star that objective. 2. Unit Test **on Day 11** 3. Hand in Human Genome Project – **DAY 11 and 12** we will discuss as time is available either before test or after test. |